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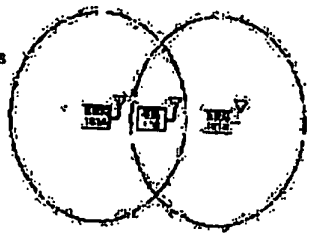
(54) AVOIDANCE METHOD OF ASYNCHRONOUS INTERFERENCE AND AVOIDANCE SYSTEM OF ASYNCHRONOUS INTERFERENCE

(57)Abstract:
PROBLEM TO BE SOLVED: To surely enable avoidance of asynchronous interference by a communication system, using a TDMA-TDD which consists of a master station and slave stations or the like.
SOLUTION: When an asynchronous interference is detected, the highest slot of a receiving electric field intensity is searched, an interference detecting packet is sent out by a transmitting slot corresponding to the slot and a temporary master station 101A or a temporary master station 101B causing the asynchronous interference recognizes the interference detecting packet or a channel hop is executed by the temporary master station 101A or the temporary master station 101B by an interference which is generated by the sending-out of the interference detecting packet. As a result, the avoidance of the asynchronous interference is enabled by the reliable avoidance method of the asynchronous interference.



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CLAIMS

[Claim(s)]

[Claim 1] The child office of the assumed-parents station mediation mold network which is the asynchronous interference evasion approach in a network, and can serve as an assumed-parents station temporarily The 1st process which judges whether the unique WORD for a synchronization which receives the direction packet for collision control of going down from the 1st assumed-parents station which is said assumed-parents station, and is contained in this direction packet for collision control of going down was detected, When said direction packet for collision control of going down is sent out respectively and it interferes in it mutually to the timing from which said 1st assumed-parents station and the 2nd assumed-parents station which is other assumed-parents stations differ, said child office When said unique WORD cannot be detected in said 1st process, the 2nd process which counts the count of un-detecting of said unique WORD, and said child office When the count of reception of said direction packet for collision control of going down and the count of un-detecting of said unique WORD exceed the threshold set up beforehand respectively (more than), Judge that asynchronous interference has arisen between said 1st assumed-parents station, and it stops taking said 1st assumed-parents station and synchronization, temporary — as the 3rd assumed-parents station — operating — this — the 3rd process it enables it to transmit and receive to the slot timing of the 3rd assumed-parents station, and said 3rd assumed-parents station The 4th process which judges whether the slot from which the threshold beforehand set up out of the slot in all the frequencies currently used is exceeded (above), and the strongest received field strength is obtained was looked for, and the corresponding slot was detected, Said 3rd assumed-parents station judges it as the slot in which it has interfered between said 1st assumed-parents station, when said slot which corresponds at said 4th process is detected. The count (more than) exceeding the threshold beforehand set as the transmitting slot corresponding to said detected slot in the packet for interference detection, and the 5th process sent out continuously, Said packet of interference detection from said 3rd assumed-parents station Said 1st assumed-parents station, When sent out in accordance with the timing in the receiving slot of said 2nd assumed-parents station, or said 1st assumed-parents station, Or the 6th process which avoids interference of said direction packet for collision control of going down from hopping to the channel which said 2nd assumed-parents station has recognized reception of said packet of interference detection, and was computed with the random number, When said 3rd assumed-parents station hops to a channel with said 1st new assumed-parents station at said 6th process, The asynchronous interference evasion approach which hops to the channel corresponding to the channel of said 1st assumed-parents station, and is characterized by having the 7th process which receives said direction packet for collision control of going down from return and said 1st assumed-parents station at actuation of said child office.
[Claim 2] When said packet of interference detection shifted from the timing in the slot of said 1st assumed-parents station and said 2nd assumed-parents station and said 6th process is sent out from said 3rd assumed-parents station, If said 1st assumed-parents station and said 2nd assumed-parents station are counted exceeding the threshold set up beforehand (above), the count of un-detecting of said unique WORD at the period which could not detect said unique

WORD but was set up beforehand The asynchronous interference evasion approach according to claim 1 characterized by including the process which hops to the channel which judged respectively that it was the slot in which it has interfered, and was respectively computed with the random number.
[Claim 3] When said slot which corresponds at said 4th process cannot be detected, said 5th process said 3rd assumed-parents station If it judges that it was finished whether investigating all the slots and has finished investigating The asynchronous interference evasion approach according to claim 1 or 2 characterized by shifting the timing of said slot a semicircle term and including the 8th process which returns to said 4th process which investigates the received field strength of all slots.
[Claim 4] Said 8th process is the asynchronous interference evasion approach according to claim 1 to 3 characterized by including the process which ends processing when all the slots finish being investigated.
[Claim 5] When, as for said 1st process, said 1st assumed-parents station and said 2nd assumed-parents station have synchronized and sent out said direction packet for collision control of going down respectively using the same channel, Said child office detects said unique WORD, and since it becomes the packet with which the signal from said 1st assumed-parents station and the signal from said 2nd assumed-parents station interfered, an error is detected. When the count of reception of said direction packet for collision control of going down and the count of error detection of a packet exceed the threshold set up beforehand respectively (more than), The 9th process which judges that interference has arisen between said 1st assumed-parents station, and sends out the packet of a channel change demand to said 1st assumed-parents station and said 2nd assumed-parents station, Said 1st assumed-parents station and said 2nd assumed-parents station are the asynchronous interference evasion approach according to claim 1 to 4 characterized by including the 10th process which hops to the channel which received the packet of said channel change demand and was respectively computed with the random number.
[Claim 6] When, as for said 1st process, said 1st assumed-parents station and said 2nd assumed-parents station have sent out said direction packet for collision control of going down respectively by the separate channel, Said child office is the asynchronous interference evasion approach according to claim 1 to 5 characterized by including the process which detects said unique WORD, judges that said 1st assumed-parents station and synchronization can be taken since there is no detection of the error of a packet, and operates according to actuation of the usual ad hoc protocol.
[Claim 7] Said 3rd process is the asynchronous interference evasion approach according to claim 1 to 6 characterized by returning to said 1st process when the count of reception of said direction packet for collision control of going down is below the threshold (following) set up beforehand, or when the count of un-detecting of said unique WORD is below the threshold (following) set up beforehand.
[Claim 8] Said 9th process is the asynchronous interference evasion approach according to claim 1 to 7 characterized by returning to said 1st process when the count of reception of said direction packet for collision control of going down is below the threshold (following) set up beforehand, or when said count of error detection of said packet is below the threshold (following) set up beforehand.
[Claim 9] When, as for said 3rd process, said child office operates as 3rd assumed-parents station temporarily, The count exceeding the threshold beforehand set up in said packet of interference detection by all the slots that can be used (more than), The asynchronous interference evasion approach according to claim 1 to 8 characterized by not performing processing in said the 4th process and said 5th process when this 10th process is performed including the 10th process sent out continuously.
[Claim 10] Said 4th process investigates whether said unique WORD is detected, when said corresponding slot is detected. The actuation which investigates whether the location of said slot is shifted before [a bit of] "1", and said unique WORD is detected when said unique WORD is not detected When said unique WORD is repeatedly detected in the range which can detect

electric field. By sending out the packet of a channel change demand by the transmitting slot corresponding to said slot, said 1st assumed-parents station, Or the asynchronous interference evasion approach according to claim 1 to 9 characterized by not performing processing in said 5th process when this 11th process is performed including the 11th process to which channel hop is carried out to said 2nd assumed-parents station.

[Claim 11] The storage with which the program which can perform the asynchronous interference evasion approach according to claim 1 to 10 was recorded.

[Claim 12] The TDMA-TDD processing section which is an asynchronous interference evasion system in a network, and performs processing about TDMA-TDD, The clock section which generates a periodic pulse signal and is supplied to said RF section and said TDMA-TDD processing section, The ad hoc protocol processing section which processes the protocol used in an ad hoc network, The number storage section of receive packets which counts and memorizes the packet which received, The count storage section of unique WORD un-detecting which memorizes the count from which the unique WORD which the direction packet for collision control of going down sent out from the assumed-parents station of said network has was un-detecting, The count storage section of error detection which memorizes the count of error detection produced in the packet which received, It has the hop place channel calculation section which computes the channel which generates a random number and hops. It has two or more child offices which can operate said assumed-parents office temporarily. Said ad hoc protocol processing section Said unique WORD for said TDMA-TDD processing section to take the synchronization with said assumed-parents station and said child office is detected. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of error detection of the receive packet in said count storage section of error detection exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in the assumed-parents station of [1st] said assumed-parents stations which transmit information to said child office, and other 2nd assumed-parents station. Said TDMA-TDD processing section of said child office cannot detect said unique WORD. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of unique WORD un-detecting in said count storage section of unique WORD un-detecting exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in said the 1st assumed-parents station and said child office. Said TDMA-TDD processing section Based on decision that there is interference by said 1st assumed-parents station in said ad hoc protocol processing section, and said 2nd assumed-parents station, the RF section which performs transmission and reception, modulation, and recovery of an electric wave is minded. The packet of a channel change demand is sent out to said 1st assumed-parents station and said 2nd assumed-parents station. It is based on decision of interference with said 1st assumed-parents station in said ad hoc protocol processing section, and said child office. The threshold beforehand set up out of the slot in all the frequencies that are operating by the function of the 3rd assumed-parents station temporarily, and are used is exceeded (with above). The packet for interference detection is continuously sent out the number of times set up beforehand from the transmitting slot corresponding to the slot from which the strongest received field strength is obtained. And said hop place channel calculation section It is based on said packet of the channel change demand which received in said 1st assumed-parents station and said 2nd assumed-parents station. The channel which generates a random number respectively and hops to a degree is computed. Said 1st assumed-parents station, Or when reception of said packet of interference detection is judged in said 2nd assumed-parents station, Or when it judges said unique WORD of said packet of interference detection un-detecting, Or when said packet of interference detection is judged as an error packet by which the error was detected, The channel which generates a random number and hops to a degree in order to avoid interference is computed. Said 3rd assumed-parents station When said 1st assumed-parents station carries out channel hop, after hopping to the channel corresponding to the channel of said 1st assumed-parents station, The asynchronous interference evasion system characterized by receiving said direction packet for collision control of going down from said 1st assumed-parents station as return and said child office in actuation by the function of said child office.

[Claim 13] The frame processing section which passes only the packet in which said TDMA-TDD processing section has the relation to said ad hoc protocol processing section among the packets received from said RF section to said ad hoc protocol processing section, The slot processing section which embeds into the slot which had the transmitting packet which took out the receive packet of the slot specified out of the receiving bit string received from said RF section, and was received from said frame processing section specified, and is passed to said RF section, With the unique WORD Banking Inspection Department which notifies the result of whether said unique WORD was detected from the receive packet, and said unique WORD was detected to said ad hoc protocol processing section Investigate whether there is any error in a receive packet, and the result of error detection is notified to said ad hoc protocol processing section. The error detection section which receives a receive packet from the unique WORD Banking Inspection Department which detected delivery and said unique WORD for the packet which received in said frame processing section when an error was not detected, It has a field strength investigation means to investigate said received field strength, Said ad hoc protocol processing section For every non-detected notice of said unique WORD from said unique WORD Banking Inspection Department "1" is added and stored in the value of said count storage section of unique WORD un-detecting. "1" is added and stored in the value of said count storage section of error detection for every error indication of a receive packet from said error detection section. Detection of said unique WORD from said unique WORD Banking Inspection Department, Or the asynchronous interference evasion system according to claim 12 characterized by storing "1" In addition to the value of said number storage section of receive packets for every non-detected notice.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention belongs to the technique about the asynchronous interference evasion approach and asynchronous interference evasion system which avoid interference of the electric wave between a key station and a child office.
[0002]
[Description of the Prior Art] The method which avoids asynchronous interference to JP,7-67189,A is proposed as a conventional asynchronous interference evasion method.
[0003] Drawing 11 is the block diagram showing an example of a method which avoids asynchronous interference of the conventional technique. As shown in drawing 11 , this conventional method consists of a wireless communication control unit 1, wireless contacts 2, 3, 4, and 5, and migration machines 6, 7, 8, and 9.
[0004] The wireless communication control unit 1 performs exchange control with a common public network or other mobile communication system, and the wireless circuit in a system, migration management of the migration machines 6, 7, 8, and 9, and wireless management of a system. The wireless contacts 2, 3, 4, and 5 supervise a radio channel while carrying out setup and release of a wireless circuit with the migration machines 6, 7, 8, and 9 under management of the wireless communication control unit 1. The migration machines 6, 7, 8, and 9 communicate through the wireless contacts 2, 3, 4, and 5 and the wireless communication control unit 1, moving in the inside of a system.
[0005] The wireless zones 10A, 10B, 10C, and 10D are respectively set up to the wireless contacts 2, 3, 4, and 5.
[0006] Drawing 12 is the block diagram showing the configuration of the wireless contacts 2, 3, 4, and 5 of drawing 11 .
[0007] The wireless contacts 2, 3, 4, and 5 consist of antenna section 101X, the wireless section 102, the modem section 103, frame generation / decomposition section 104, the control channel control section 105, the communication channel control section 106, an asynchronous interference detecting element 107, the interface section 108, and a slot synchronizer 109.
[0008] Drawing 13 is drawing showing the flow of the actuation in the wireless communication control unit 1 of drawing 11 . Here, the migration machine 6 and the wireless contact 2 are lifted, and actuation of the wireless communication control unit 1 is explained. The migration machine 6 and the wireless contact 2 carry out to it being under communication link using slot 2S of a frequency f1. The slot for reserve channels (in this case, slot 4S) which is not usually used is prepared for the wireless contact 2, and the empty carrier is searched using this slot for reserve channels. The information about this empty carrier is put on slot 2S under communication link, is vacant, and is notified to the migration machine 6 as a notice of carrier information (in this case, a frequency f2, slot 4S). When an empty carrier becomes unusable, a new empty channel is searched, updated and notified.
[0009] In the meantime, the wireless contact 2 measures the receiving level of two or more points in slot 2S under communication link by the asynchronous interference detecting element 107, and reports the result to the communication channel control section 106. When the

communication channel control section 106 performs asynchronous interference detection in connection with this measurement result and asynchronous interference is detected, it changes to the communication channel (a frequency f2, slot 4S) notified as empty carrier information. The migration machine 6 detects that the signal transmission which has received until now cannot receive, and changes it to the communication channel (a frequency f2, slot 4S) notified beforehand. In addition, forming the asynchronous interference detecting element 107 in the migration machine 6 side, and also making it operate similarly is performed. All over drawing, slot 1S and slot 3S are shown, and other explanation is omitted.
[0010] Moreover, in No. 2553286 of a patent official report, the technique about the asynchronous interference evasion approach which becomes possible [detecting especially effectively exactly interference which an asynchronous interference wave does from the back of the burst frame in the signal wave of choice of a digital mobile radio communication link of time-division system, and starting interference evasion actuation efficiently] is exhibited.
[0011]
[Problem(s) to be Solved by the Invention] However, there was a trouble hung up over below in the conventional technique. When coping with the asynchronous interference between the wireless contacts 2, 3, and 4 and 5 using the conventional asynchronous interference evasion method, an asynchronous interference detecting element will be prepared in the terminal side which are the migration machines 6, 7, 8, and 9. Then, although hopped to the communication channel as for which the terminal side detected interference by the asynchronous interference detecting element and which was notified beforehand, by not receiving the signal from a terminal side, the wireless contacts 2, 3, 4, and 5 will detect asynchronous interference, and will carry out channel hop. However, having consumed the power of a dc-battery other than the factor as for which interference generated and stopping receiving the signal from a terminal side if the terminal side is operating with the dc-battery carried out channel hop was also considered, and decision that interference occurred had the trouble of not being certain, by not receiving the signal from a terminal side.
[0012] This invention is made in view of this trouble, and the place made into the purpose is in the point of offering the technique about the asynchronous interference evasion approach and asynchronous interference evasion system which avoid interference certainly because an assumed-parents station makes a reception judgment of the packet for the interference detection transmitted from the child office in the assumed-parents station mediation mold network where an assumed-parents station exists.
[0013]
[Means for Solving the Problem] The summary of this invention according to claim 1 is the asynchronous interference evasion approach in a network. The direction packet for collision control of going down is received from the 1st assumed-parents station whose child office of the assumed-parents station mediation mold network which can serve as an assumed-parents station temporarily is said assumed-parents station. The 1st process which judges whether the unique WORD for a synchronization contained in this direction packet for collision control of going down was detected, When said direction packet for collision control of going down is sent out respectively and it interferes in it mutually to the timing from which said 1st assumed-parents station and the 2nd assumed-parents station which is other assumed-parents stations differ, said child office When said unique WORD cannot be detected in said 1st process, the 2nd process which counts the count of un-detecting of said unique WORD, and said child office When the count of reception of said direction packet for collision control of going down and the count of un-detecting of said unique WORD exceed the threshold set up beforehand respectively (more than), Judge that asynchronous interference has arisen between said 1st assumed-parents station, and it stops taking said 1st assumed-parents station and synchronization. temporary — as the 3rd assumed-parents station — operating — this — the 3rd process it enables it to transmit and receive to the slot timing of the 3rd assumed-parents station, and said 3rd assumed-parents station The 4th process which judges whether the slot from which the threshold beforehand set up out of the slot in all the frequencies currently used is exceeded (above), and the strongest received field strength is obtained was looked for, and the

corresponding slot was detected, Said 3rd assumed-parents station judges it as the slot in which it has interfered between said 1st assumed-parents station, when said slot which corresponds at said 4th process is detected. The count (more than) exceeding the threshold beforehand set as the transmitting slot corresponding to said detected slot in the packet for interference detection, and the 5th process sent out continuously, Said packet of interference detection from said 3rd assumed-parents station Said 1st assumed-parents station, When sent out in accordance with the timing in the receiving slot in said 2nd assumed-parents station, or said 1st assumed-parents station, Or the 6th process which avoids interference of said direction packet for collision control of going down from hopping to the channel which said 2nd assumed-parents station has recognized reception of said packet of interference detection, and was computed with the random number, When said 3rd assumed-parents station hops to a channel with said 1st new assumed-parents station at said 6th process, It hops to the channel corresponding to the channel of said 1st assumed-parents station, and consists in the asynchronous interference evasion approach characterized by having the 7th process which receives said direction packet for collision control of going down from return and said 1st assumed-parents station in actuation of said child office. The summary of this invention according to claim 2 said 5th process When said packet of interference detection shifted from the timing in the slot of said 1st assumed-parents station and said 2nd assumed-parents station and is sent out from said 3rd assumed-parents station, If said 1st assumed-parents station and said 2nd assumed-parents station are counted exceeding the threshold set up beforehand (above), the count of un-detecting of said unique WORD at the period which could not detect said unique WORD but was set up beforehand It judges respectively that it is the slot in which it has interfered, and consists in the asynchronous interference evasion approach according to claim 1 characterized by including the process which hops to the channel respectively computed with the random number. The summary of this invention according to claim 3 said 5th process When said slot which corresponds at said 4th process cannot be detected, said 3rd assumed-parents station If it judges that it was finished whether investigating all the slots and has finished investigating The timing of said slot is shifted a semicircle term and it consists in the asynchronous interference evasion approach according to claim 1 or 2 characterized by including the 8th process which returns to said 4th process which investigates the received field strength of all slots. The summary of this invention according to claim 4 consists in the asynchronous interference evasion approach according to claim 1 to 3 characterized by said 8th process including the process which ends processing when all the slots finish being investigated. The summary of this invention according to claim 5 said 1st process When said 1st assumed-parents station and said 2nd assumed-parents station have synchronized and sent out said direction packet for collision control of going down respectively using the same channel, Said child office detects said unique WORD, and since it becomes the packet with which the signal from said 1st assumed-parents station and the signal from said 2nd assumed-parents station interfered, an error is detected. When the count of reception of said direction packet for collision control of going down and the count of error detection of a packet exceed the threshold set up beforehand respectively (more than), The 9th process which judges that interference has arisen between said 1st assumed-parents station, and sends out the packet of a channel change demand to said 1st assumed-parents station and said 2nd assumed-parents station, Said 1st assumed-parents station and said 2nd assumed-parents station receive the packet of said channel change demand, and consist in the asynchronous interference evasion approach according to claim 1 to 4 characterized by including the 10th process which hops to the channel respectively computed with the random number. The summary of this invention according to claim 6 said 1st process When said 1st assumed-parents station and said 2nd assumed-parents station have sent out said direction packet for collision control of going down respectively by the separate channel, It is judged that said 1st assumed-parents station and synchronization have been taken since said child office detects said unique WORD and does not have detection of the error of a packet. It consists in the asynchronous interference evasion approach according to claim 1 to 5 characterized by including the process which operates according to actuation of the usual ad hoc protocol. For said 3rd process, the summary of this invention according to claim 7 is the

description about returning to said 1st process, when the count of reception of said direction packet for collision control of going down is below the threshold (following) set up beforehand, or when the count of un-detecting of said unique WORD is below the threshold (following) set up beforehand. It consists in the asynchronous interference evasion approach according to claim 1 to 6 to carry out. The summary of this invention according to claim 8 consists in the asynchronous interference evasion approach according to claim 1 to 7 characterized by said 9th process returning to said 1st process when the count of reception of said direction packet for collision control of going down is below the threshold (following) set up beforehand, or when said count of error detection of said packet is below the threshold (following) set up beforehand. The summary of this invention according to claim 9 said 3rd process The count exceeding the threshold beforehand set up in said packet of interference detection by all the slots that can be used when said child office operated as 3rd assumed-parents station temporarily (more than), When this 10th process is performed including the 10th process sent out continuously, it consists in the asynchronous interference evasion approach according to claim 1 to 8 characterized by not performing processing in said the 4th process and said 5th process. The summary of this invention according to claim 10 said 4th process When said corresponding slot is detected, it investigates whether said unique WORD is detected. The actuation which investigates whether the location of said slot is shifted before [a bit of] "1", and said unique WORD is detected when said unique WORD is not detected When said unique WORD is repeatedly detected in the range which can detect electric field, By sending out the packet of a channel change demand by the transmitting slot corresponding to said slot, said 1st assumed-parents station, Or when this 11th process is performed including the 11th process to which channel hop is carried out to said 2nd assumed-parents station, it consists in the asynchronous interference evasion approach according to claim 1 to 9 characterized by not performing processing in said 5th process. The summary of this invention according to claim 11 consists in the storage with which the program which can perform the asynchronous interference evasion approach according to claim 1 to 10 was recorded. The TDMA-TDD processing section which the summary of this invention according to claim 12 is an asynchronous interference evasion system in a network, and performs processing about TDMA-TDD, The clock section which generates a periodic pulse signal and is supplied to said RF section and said TDMA-TDD processing section, The ad hoc protocol processing section which processes the protocol used in an ad hoc network, The number storage section of receive packets which counts and memorizes the packet which received, The count storage section of unique WORD un-detecting which memorizes the count from which the unique WORD which the direction packet for collision control of going down sent out from the assumed-parents station of said network has was un-detecting. The count storage section of error detection which memorizes the count of error detection produced in the packet which received, It has the hop place channel calculation section which computes the channel which generates a random number and hops. It has two or more child offices which can operate said assumed-parents office temporarily. Said ad hoc protocol processing section Said unique WORD for said TDMA-TDD processing section to take the synchronization with said assumed-parents station and said child office is detected. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of error detection of the receive packet in said count storage section of error detection exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in the assumed-parents station of [1st] said assumed-parents stations which transmit information to said child office, and other 2nd assumed-parents station. Said TDMA-TDD processing section of said child office cannot detect said unique WORD. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of unique WORD un-detecting in said count storage section of unique WORD un-detecting exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in said the 1st assumed-parents station and said child office. Said TDMA-TDD processing section Based on the decision in which said 1st assumed-parents station in said ad hoc protocol processing section and said 2nd assumed-parents station interfere, the RF section which performs

transmission and reception, modulation, and recovery of an electric wave is minded. The packet of a channel change demand is sent out to said 1st assumed-parents station and said 2nd assumed-parents station. It is based on decision of interference with said 1st assumed-parents station in said ad hoc protocol processing section, and said child office. The threshold beforehand set up out of the slot in all the frequencies that are operating by the function of the 3rd assumed-parents station temporarily, and are used is exceeded (with above). The packet for interference detection is continuously sent out the number of times set up beforehand from the transmitting slot corresponding to the slot from which the strongest received field strength is obtained. And said hop place channel calculation section It is based on said packet of the channel change demand which received in said 1st assumed-parents station and said 2nd assumed-parents station. The channel which generates a random number respectively and hops to a degree is computed. Said 1st assumed-parents station, Or when reception of said packet of interference detection is judged in said 2nd assumed-parents station, Or when it judges said unique WORD of said packet of interference detection un-detecting, Or when said packet of interference detection is judged as an error packet by which the error was detected, The channel which generates a random number and hops to a degree in order to avoid interference is computed. Said 3rd assumed-parents station When said 1st assumed-parents station carries out channel hop, after hopping to the channel corresponding to the channel of said 1st assumed-parents station, it consists in the asynchronous interference evasion system characterized by receiving said direction packet for collision control of going down from said 1st assumed-parents station as return and said child office in actuation by the function of said child office. The summary of this invention according to claim 13 said TDMA-TDD processing section The frame processing section which passes only the packet which is related to said ad hoc protocol processing section among the packets received from said RF section to said ad hoc protocol processing section, The slot processing section which embeds into the slot which had the transmitting packet which took out the receive packet of the slot specified out of the receiving bit string received from said RF section, and was received from said frame processing section specified, and is passed to said RF section, He is said ad hoc pro about the result of whether said unique WORD was detected from the receive packet, and said unique WORD was detected. It investigates [the unique WORD Banking Inspection Department which notifies to the TOKORU processing section, and] whether there is any error in a receive packet. When the result of error detection was notified to said ad hoc protocol processing section and an error is not detected, The error detection section which receives a receive packet from the unique WORD Banking Inspection Department which detected delivery and said unique WORD for the packet which received in said frame processing section, It has a field strength investigation means to investigate said received field strength. Said ad hoc protocol processing section For every non-detected notice of said unique WORD from said unique WORD Banking Inspection Department "1" is added and stored in the value of said count storage section of unique WORD un-detecting. "1" is added and stored in the value of said count storage section of error detection for every error indication of a receive packet from said error detection section. Detection of said unique WORD from said unique WORD Banking Inspection Department, Or it consists in the asynchronous interference evasion system according to claim 12 characterized by storing "1" in addition to the value of said number storage section of receive packets for every non-detected notice.

[0014]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing.

[0015] (Gestalt 1 of operation) Drawing 1 is drawing showing the outline of Network A of performing the asynchronous interference evasion approach concerning the gestalt 1 of this operation. As shown in drawing 1 , Network A is an ad hoc network which an outline configuration is carried out and can ****** on that spot in the assumed-parents office 101 and two or more child offices 110, 111, and 112, and is an assumed-parents office mediation mold network where the assumed-parents office 101 exists.

[0016] The internal configuration of the assumed-parents station 101 and the child offices 110, 111, and 112 is the same, and it calls these station equipment collectively [the internal configuration]. One set becomes the assumed-parents office 101 out of two or more office equipments, and drawing 1 shows the condition that other office equipments are functioning as child offices 110, 111, and 112.

[0017] Next, the synchronization with the assumed-parents station 101 and the child office 110 (it represents out of the child offices 110, 111, and 112) is explained. Drawing 2 is drawing showing the synchronization between the assumed-parents office 101 of drawing 1 , and the child office 110.

[0018] The communication link between the assumed-parents station 101 and the child office 110 uses TDMA-TDD (Time Division Multiple Access-Time DivisionDuplex), and a TDMA multiplex number is "4." In Network A, one slot per ad hoc network A is used. The assumed-parents station 101 does not carry out taking the child office 110 and a synchronization, but operates to the slot timing of assumed-parents station 101 itself.

[0019] The child office 110 takes a synchronization so that the transmitting slot 114 of the assumed-parents station 101 and the receiving slot 117 of the child office 110 may correspond, and so that the receiving slot 115 of the assumed-parents station 101 and the transmitting slot 116 of the child office 110 may correspond.

[0020] In order for two or more child offices 110, 111, and 112 to share one slot in the receiving slot 115 of the assumed-parents station 101, the assumed-parents station 101 needs to cope with possibility that two or more child offices 110, 111, and 112 send out a packet to coincidence.

[0021] In Network A, the ICMA-PE (Idle-signal casting multiple access with partial echo) technique is used as the control approach of such a collision. In ICMA-PE, it gets down for collision control and the direction packet (the direction packet for collision control of going down is called hereafter) CP is always sent out to the child offices 110, 111, and 112 using the transmitting slot 114.

[0022] Drawing 3 is drawing showing the configuration of the direction packet CP for collision control of drawing 2 of going down. As shown in drawing 3 , the direction packet CP for collision control of going down gets down with unique WORD 201, and an outline configuration is carried out from an information signal 202, the free line / prohibition bit 203, reception / non-receiving bit 204, the partial echo field 205, and the error detection field 206.

[0023] Unique WORD 201 is the field for taking a synchronization, and is the bit pattern set up beforehand. It gets down and an information signal 202 is data transmitted from the assumed-parents station 101 to the child offices 110, 111, and 112. A free line / prohibition bit 203 displays "prohibition", when data are being received from a specific child office, and when forbidding access from other child offices, it is used.

[0024] Reception / non-receiving bit 204 displays "reception", when a signal without an error is received correctly, and when neither the case where there is an error which cannot be corrected, nor the signal is received, it indicates "un-receiving." When it indicates "un-receiving" during signal transmission, the child offices 110, 111, and 112 under data packet transmission halt transmit information, and go into a resending procedure.

[0025] The partial echo field 205 judges whether some received data are displayed, the child offices 110, 111, and 112 collate the information on this partial echo field 205, and the information which the local station sent, and the information which the local station sent is received correctly. The error detection field 206 does not have an error in the packet which received, or is used for a check.

[0026] In Network A, since the frequency which can be used can use four slots to those with 3 waves, and each frequency, a total of 12 channels exist. when it is judged that it investigates whether the assumed-parents station 101 is vacant, comes out and there is about each channel when building an ad hoc network, and comes out [it is vacant and], the direction packet CP for collision control of going down is continuously sent out using the channel [any]

[0027] Drawing 4 is the block diagram showing the outline configuration of the child offices 110, 111, and 112 of drawing 1 . As shown in drawing 4 , the outline configuration of the office equipment is carried out from the RF section 301, the clock section 302, the TDMA-TDD

processing section 303, the ad hoc protocol processing section 304, the number storage section 305 of receive packets, the count storage section 306 of unique WORD un-detecting, the count storage section 307 of error detection, and the hop place channel calculation section 308.

[0028] The RF section 301 performs transmission and reception of an electric wave, a modulation, and a recovery. The clock section 302 generates a periodic pulse signal, and supplies it to the RF section 301 and the TDMA-TDD processing section 303.

[0029] The TDMA-TDD processing section 303 is equipped with the slot processing section 3031, the unique WORD Banking Inspection Department 3032, the error detection section 3033, the frame processing section 3034, and the field strength investigation means 3035, and performs processing about TDMA-TDD.

[0030] The slot processing section 3031 is embedded into the slot which had the transmitting packet which took out the receive packet from the slot specified out of the receiving bit string received from the RF section 301, and was received from the frame processing section 3034 specified, and is passed to the RF section 301.

[0031] The unique WORD Banking Inspection Department 3032 detects unique WORD 201 from the packet which received. The result of whether unique WORD 201 was detected is notified to the ad hoc protocol processing section 304. A receive packet is passed to the error detection section 3033 when unique WORD 201 is detected.

[0032] The error detection section 3033 investigates whether there is any error in the packet which received. The result of error detection is notified to the ad hoc protocol processing section 304. The packet which received is passed to the frame processing section 3034 when an error is not detected. The frame processing section 3034 passes only the packet which is related to the ad hoc protocol processing section 304 among the received packets to the ad hoc protocol processing section 304.

[0033] The ad hoc protocol processing section 304 processes the protocol used in an ad hoc network. The number storage section 305 of receive packets counts and memorizes the packet which received. The field strength investigation means 3035 investigates received field strength.

[0034] The count storage section 306 of unique WORD un-detecting memorizes the count from which unique WORD 201 was un-detecting at the predetermined period.

[0035] The count storage section 307 of error detection memorizes the count of error detection produced at the predetermined period. If un-detecting [of unique WORD 201] is notified to the ad hoc protocol processing section 304 from the unique WORD Banking Inspection Department 3032, "1" is added to the count memorized by the count storage section 306 of unique WORD un-detecting, and the value is again stored in the count storage section 306 of unique WORD un-detecting. Moreover, if it is notified that there was an error of a receive packet from the error detection section 3033, "1" is added to the count stored in the count storage section 307 of error detection, and the value is again stored in the count storage section 307 of error detection. Moreover, if the notice which is not detected [detection or] is received from the unique WORD Banking Inspection Department 3032, "1" is added to the value stored in the number storage section 305 of receive packets, and the value is again stored in the number storage section 305 of receive packets. When this value turns into a predetermined value (for example, 240) set up beforehand, the ad hoc protocol processing section 304 reads the value memorized by the count storage section 306 of unique WORD un-detecting, and the count storage section 307 of error detection. If it is beyond the predetermined value (for example, 120) to which these values were set beforehand, it will judge that interference has occurred and actuation of interference evasion will be taken. "0" will be set to each of the number storage section 305 of receive packets, the count storage section 306 of unique WORD un-detecting, and the count storage section 307 of error detection if decision whether this interference has occurred finishes. The hop place channel calculation section 308 computes the channel which should hop to the degree in the case of hopping to other channels using a random number. In the case of the assumed-parents office 101, a random number is generated by making into the base ID assigned uniquely every assumed-parents office 101. In the case of the child offices 110, 111, and 112, a random number is generated using ID of the assumed-parents station 101 reported from the assumed-parents station 101.

[0036] Drawing 5 is drawing showing an example of the physical relationship of assumed-parents office (1st assumed-parents office) 101A and assumed-parents office (2nd assumed-parents office) 101B in the asynchronous interference evasion system concerning the gestalt 1 of this operation, and the child office 110. As shown in drawing 5, it is drawing showing the case where the child office 110 is located in the location which can receive respectively the direction packet CP for collision control of going down from assumed-parents office 101A and assumed-parents office 101B.

[0037] Drawing 6 is a flow chart which shows the actuation in the asynchronous interference evasion system concerning the gestalt 1 of this operation.

[0038] Next, actuation of the asynchronous interference evasion system applied to the gestalt 1 of this operation with reference to drawing 5 and drawing 6 is explained in detail.

[0039] The following three cases in case the child office 110 is going to receive the direction packet CP for collision control of going down from assumed-parents station 101A are explained.

[0040] The 1st case where assumed-parents station 101A and assumed-parents station 101B have transmitted the direction packet CP for collision control of going down by the separate channel to the child office 110, While assumed-parents station 101A and the child office 110 communicate, assumed-parents station 101B carries out channel hop at the same channel as assumed-parents station 101A. In the condition that assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down using the same channel The 2nd case where transmission and reception of assumed-parents station 101A and assumed-parents station 101B completely synchronize, and are transmitted to the timing that the direction packet CP for collision control of going down is completely the same, Assumed-parents station 101A and assumed-parents station 101B are the 3rd case where do not synchronize but the direction packet CP for collision control of going down to the child office 110 has caused asynchronous interference.

[0041] When, as for the 1st case, assumed-parents station 101A and assumed-parents station 101B have transmitted the direction packet CP for collision control of going down by the separate channel and the child office 110 receives the direction packet CP for collision control of going down from assumed-parents station 101A, the unique WORD Banking Inspection Department 3032 detects unique WORD 201, and the error detection section 3033 is the case where an error is not detected.

[0042] first — the slot processing section 3031 — a packet — receiving (step 401) — the packet which received is sent to the unique WORD Banking Inspection Department 3032.

[0043] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 (shown in drawing 2) set up beforehand is detected (step 402).

[0044] In this case, since unique WORD 201 is detected (inside of drawing, Yes), it recognizes that the child office 110 has taken assumed-parents station 101A and a synchronization, and judges whether the error was detected by the packet by which this packet has been sent to the error detection section 3033 in delivery and the error detection section 3033 (step 403).

[0045] In this case, the sent packet (receive packet) is passed to the frame processing section 3034 by that (inside of drawing, No) by which an error is not detected (step 404).

[0046] In the frame processing section 3034, the class of packet which received is investigated and, in the case of the packet related to the ad hoc protocol processing section 304, the packet is passed to the ad hoc protocol processing section 304 (step 405).

[0047] The ad hoc protocol processing section 304 investigates the received packet, and operates according to actuation of an ad hoc protocol henceforth (step 406 (processing according to a receive packet is performed in the ad hoc protocol processing section 304)).

[0048] Drawing 7 is drawing showing an example of a condition synchronous [in drawing 6]. Next, the 2nd case is explained with reference to drawing 5 , drawing 6 , and drawing 7 . All over drawing, the transmitting slot 114 of assumed-parents station 101A and assumed-parents station 101B, the receiving slot 115, and the transmitting slot 116 and the receiving slot 117 of the child office 110 are shown.

[0049] Although assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down using the same channel,

transmission and reception with assumed-parents station 101A and assumed-parents station 101B completely synchronize, and the case where the direction packet CP for collision control of going down is sent out to the completely same timing is explained.

[0050] In this case, the child office 110 — the slot processing section 3031 — a packet — receiving (step 401) — the packet which received is sent to the unique WORD Banking Inspection Department 3032.

[0051] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 set up beforehand is detected (step 402).

[0052] In this case, the direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B can be received, without being sent out to the completely same timing, and the signal of unique WORD 201 part deforming from assumed-parents station 101A and assumed-parents station 101B, since unique WORD 201 of the direction packet CP for collision control of going down is the same. Therefore, by that (inside of drawing, Yes) which can detect unique WORD 201, it recognizes that the child office 110 has taken assumed-parents station 101A and a synchronization, and the packet which received in the unique WORD Banking Inspection Department 3032 is sent to the error detection section 3033.

[0053] In the error detection section 3033, it judges whether the error was detected by the sent packet (step 403). Since the packet which received turns into a packet with which the signal of the signal of assumed-parents station 101A and assumed-parents station 101B interfered, it is that by which an error is detected in the error detection section 3033 (inside of drawing, Yes), and notifies that the error was detected to the ad hoc protocol processing section 304 (step 407).

[0054] If the notice by which the error was detected is received, the ad hoc protocol processing section 304 adds "1" to the count of error detection currently recorded on the count storage section 307 of error detection (step 408), and stores the value in the count storage section 307 of error detection.

[0055] This condition is repeated and it judges whether the value stored in the number storage section 305 of receive packets exceeded the threshold (for example, 240) set up beforehand (step 409 (the value stored in the number storage section 305 of receive packets exceeded the threshold ?)).

[0056] When it is not over the threshold at step 409 (inside of drawing, No), it returns to step 401.

[0057] When a threshold is exceeded at step 409 (inside of drawing, Yes), it judges whether the value of the count storage section 307 of error detection exceeded the predetermined threshold (for example, 120 times) (step 410 (the count of error detection exceeded the threshold ?)).

[0058] When it is not over the threshold at step 410 (inside of drawing, No), it returns to step 401.

[0059] When a threshold is exceeded at step 410 (inside of drawing, Yes), it is judged that interference has produced the ad hoc protocol processing section 304. As opposed to the frame processing section 3034 the packet of the channel change demand CS 1 (shown in drawing 7) delivery and the frame processing section 3034 Delivery and the slot processing section 3031 send out channel change demand CS1 packet for the packet from the ad hoc protocol processing section 304 to the slot processing section 3031 through the RF section 301 towards assumed-parents station 101A and assumed-parents station 101B (step 411).

[0060] Assumed-parents station 101A and assumed-parents station 101B which received channel change demand CS1 packet compute the channel which should hop to a degree using a random number, and perform channel hop respectively.

[0061] Drawing 8 is drawing showing other examples of a condition synchronous [in drawing 6]. The 3rd case is explained with reference to drawing 5 , drawing 6 , and drawing 8 . Assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down to the child office 110 using the same channel, and further, assumed-parents station 101A and assumed-parents station 101B do not synchronize, but explain the 3rd case where the direction packet CP for collision control of going down has

caused asynchronous interference.

[0062] the child office 110 — the slot processing section 3031 — a packet — receiving (step 401) — the packet which received is sent to the unique WORD Banking Inspection Department 3032.

[0063] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 set up beforehand is detected (step 402).

[0064] The direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B it interferes in the form which shifted without being sent out to the same timing. In the child office 110 Unique WORD 201 in the direction packet CP for collision control of going down which received set up beforehand is undetectable (among drawing). It becomes impossible to take No), assumed-parents station 101A, and a synchronization (assumed-parents station 101B cannot take a synchronization), and it notifies that unique WORD 201 was undetectable to the ad hoc protocol processing section 304 (step 412).

[0065] If the notice which was not able to detect unique WORD 201 is received from the unique WORD Banking Inspection Department 3032, the ad hoc protocol processing section 304 adds "1" to the count of unique WORD un-detecting stored in the count storage section 306 of unique WORD un-detecting, and stores it in the count storage section 306 of unique WORD un-detecting again (step 413 (1 is added to the count currently recorded on the count storage section 306 of unique WORD un-detecting)).

[0066] When the value stored in the number storage section 305 of receive packets judges whether the threshold (for example, 240) set up beforehand was exceeded (step 414) and is not over the threshold at step 414 (inside of drawing, No), it returns to step 401.

[0067] When it judges whether the value of the count storage section 306 of unique WORD un-detecting of ** exceeded the threshold (for example, 120 times) set up beforehand when a threshold was exceeded at step 414 (inside of drawing, Yes) (step 415 (the count of unique WORD un-detecting exceeded the threshold ?)) and is not over the threshold at step 415 (inside of drawing, No), it returns to step 401.

[0068] Judging that asynchronous interference has produced the ad hoc protocol processing section 304, when a threshold is exceeded at step 415 (inside of drawing, Yes), the child office 110 is assumed-parents station 101A (). Or it stops taking assumed-parents station 101B and a synchronization, the child office 110 turns into an assumed-parents station (un-illustrating [the 3rd assumed-parents station,]) temporarily (step 416), and it enables it to transmit and receive to its slot timing.

[0069] Next, in the child office 110 which turned into the 3rd assumed-parents station temporarily, the field strength investigation means 3035 looks for the slot from which the received field strength in all the slots of the frequency currently used is investigated, and the field strength more than the threshold (for example, 40dB) set up beforehand is detected, and the strongest received field strength is obtained (step 417). (the field strength of all slots is investigated and the slot of a heavy current community is looked for most)

[0070] It judges whether the slot looked for at step 417 was found (step 418).

[0071] When the slot looked for at step 418 is detected (inside of drawing, Yes), the 3rd assumed-parents station The detected slot judges it as the slot in which the direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B has interfered mutually. the count more than the threshold (for example, 120 times) beforehand set as it in the packet of the interference detection D1 in order to recognize an interference condition into the transmitting slot 116 corresponding to this slot — it sends out continuously (step 419 (continuation 120 slot sending out of the "interference detection" packet is carried out)).

[0072] When it is completely in agreement with the timing in assumed-parents office 101A or the receiving slot 115 of assumed-parents office 101B and the packet of this interference detection D1 is able to be sent out, assumed-parents office 101A or assumed-parents office 101B can recognize the packet of the interference detection D1. Therefore, assumed-parents station 101A which has recognized the packet of the interference detection D1, or assumed-parents station

101B acquires the channel of the hop place which the hop place channel calculation section 308 computed (step 420), hops to the acquired channel (step 421), and avoids interference of the direction packet CP for collision control of going down.

[0073] On the other hand, when it shifts from the timing in each receiving slot 115 of assumed-parents station 101A and assumed-parents station 101B and the packet of the interference detection D1 is sent out at step 419, it is with assumed-parents station 101A and assumed-parents station 101B, and unique WORD 201 is un-detecting count reception, when it carries out, it is the slot in which it has interfered more than the threshold (for example, 120) with which assumed-parents station 101A or assumed-parents station 101B was beforehand set as the period set up beforehand in the non-detected packet of unique WORD 201 — it recognizes. Assumed-parents station 101A which has recognized interference, or assumed-parents station 101B acquires the channel of the hop place which the hop place channel calculation section 308 computed (step 420), and hops to the acquired channel.

[0074] The channel of the hop place at which similarly the child office 110 which is the 3rd assumed-parents station temporarily also generated and computed the random number using ID of assumed-parents station 101A to which the hop place channel calculation section 308 is reported from assumed-parents station 101A is acquired, and it hops to the acquired channel (step 421).

[0075] The 3rd assumed-parents station returns to the child office 110 (it becomes a child office) (step 422), and tries reception of the direction packet CP for collision control of going down from assumed-parents station 101A again.

[0076] If it judges that it was finished whether conducting all slot investigations (step 423) and has finished judging at step 418 when the slot looked for is undetectable (inside of drawing, No), the timing of a slot is shifted a semicircle term (step 424), it returns to step 417, and the received field strength of all slots is investigated again.

[0077] Processing is ended when finishing judging at step 423 (inside of drawing, Yes).

[0078] Asynchronous interference evasion is made between assumed-parents station 101A and the child office 110 as mentioned above.

[0079] Since the asynchronous interference evasion approach and asynchronous interference evasion system concerning the gestalt of operation are constituted like the above, the effectiveness hung up over below is done so.

[0080] When asynchronous interference is detected, discover the highest slot of received field strength and by the transmitting slot corresponding to the slot Assumed-parents station 101A which sent out the interference detection packet and has caused asynchronous interference, Or [whether assumed-parents station 101B recognizes an interference detection packet and] Or since assumed-parents station 101A or assumed-parents station 101B is made to perform channel hop because assumed-parents station 101A or assumed-parents station 101B recognizes interference by interference produced by interference detection packet sending out, asynchronous interference evasion is enabled by the positive approach. The received electric wave in the network A equipped with many child offices is finely manageable by using this asynchronous interference evasion approach for the monitoring device of the child office 110.

[0081] (Gestalt 2 of operation) Drawing 9 is drawing showing an example of a condition synchronous [in the asynchronous interference evasion system concerning the gestalt 2 of this operation]. Since the asynchronous interference evasion structure of a system concerning the gestalt 2 of this operation is the same as that of the gestalt 1 of operation, explanation is omitted.

[0082] Although the slot with the strongest received field strength was looked for in the actuation after step 417 in drawing 6 and the packet of the interference detection D1 was sent out by the transmitting slot corresponding to the slot, as shown in drawing 9, the packet of the interference detection D1 is sent out by all slots. It becomes unnecessary in this case, to look for a slot with the strongest received field strength. Explanation of other signs is omitted.

[0083] Channel hop can be made to cause in an assumed-parents office certainly by performing this actuation compared with the gestalt 1 of operation.

[0084] (Gestalt 3 of operation) Drawing 9 is drawing showing an example of a condition

synchronous [in the asynchronous interference evasion system concerning the gestalt 3 of this operation]. Since the asynchronous interference evasion structure of a system concerning the gestalt 3 of this operation is the same as that of the gestalt 1 of operation, explanation is omitted.

[0085] If a slot with the highest received field strength is acquired at step 418 in drawing 6, it will investigate whether unique WORD 201 is detected (un-illustrating).

[0086] When unique WORD is not detected, as shown in drawing 10, the location of the slot is shifted before [a bit of] "1", and it investigates whether unique WORD 201 is detected again. This actuation is repeated in the range which can detect electric field, and it investigates whether unique WORD 201 is obtained. If unique WORD 201 is obtained, assumed-parents office 101A and the synchronization which transmit the unique WORD 201 can be taken. Therefore, by sending out the channel change demand CS 1 by the transmitting slot 116 corresponding to the receiving slot 117, a channel can be made to be able to hop to assumed-parents office 101A, without generating interference intentionally, and interference can be avoided.

[0087] In addition, in the gestalt of this operation, this invention is not limited to it, but when applying this invention, it is applicable to the technique about the suitable asynchronous interference evasion approach and a suitable asynchronous interference evasion system.

[0088] Moreover, the number of the above-mentioned configuration members, a location, a configuration, etc. are not limited to the gestalt of the above-mentioned implementation, but when carrying out this invention, they can be made into a suitable number, a location, a configuration, etc.

[0089] In addition, in each drawing, the same sign is given to the same component.

[0090]

[Effect of the Invention] Since this invention is constituted as mentioned above, the effectiveness hung up over below is done so.

[0091] In the communication mode using TDMA-TDD which consists of a key station and a child office, it is enabling asynchronous interference evasion by the positive approach. This discovers the highest slot of received field strength, when asynchronous interference is detected, and it is that an assumed-parents station recognizes interference by interference which is a transmitting slot corresponding to the discovered slot, sends out an interference detection packet, and recognizes [station / which has been started in asynchronous interference / assumed-parents] in an interference detection packet, or is produced by interference detection packet sending out, and it is because an assumed-parents station is made to perform channel hop.

[Translation done.]

TECHNICAL FIELD

[Field of the invention] This invention belongs to the technique about the asynchronous interference evasion approach and asynchronous interference evasion system which avoid interference of the electric wave between a key station and a child office.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] The method which avoids asynchronous interference to JP,7-67169,A is proposed as a conventional asynchronous interference evasion method.

[0003] Drawing 11 is the block diagram showing an example of a method which avoids asynchronous interference of the conventional technique. As shown in drawing 11, this conventional method consists of a wireless communication control unit 1, wireless contacts 2, 3, 4, and 5, and migration machines 6, 7, 8, and 9.

[0004] The wireless communication control unit 1 performs exchange control with a common public network or other mobile communication system, and the wireless circuit in a system, migration management of the migration machines 6, 7, 8, and 9, and wireless management of a system. The wireless contacts 2, 3, 4, and 5 supervise a radio channel while carrying out setup and release of a wireless circuit with the migration machines 6, 7, 8, and 9 under management of the wireless communication control unit 1. The migration machines 6, 7, 8, and 9 communicate through the wireless contacts 2, 3, 4, and 5 and the wireless communication control unit 1, moving in the inside of a system.

[0005] The wireless zones 10A, 10B, 10C, and 10D are respectively set up to the wireless contacts 2, 3, 4, and 5.

[0006] Drawing 12 is the block diagram showing the configuration of the wireless contacts 2, 3, 4, and 5 of drawing 11.

[0007] The wireless contacts 2, 3, 4, and 5 consist of antenna section 101X, the wireless section 102, the modem section 103, frame generation / decomposition section 104, the control channel control section 105, the communication channel control section 106, an asynchronous interference detecting element 107, the interface section 108, and a slot synchronizer 109.

[0008] Drawing 13 is drawing showing the flow of the actuation in the wireless communication control unit 1 of drawing 11. Here, the migration machine 6 and the wireless contact 2 are lifted, and actuation of the wireless communication control unit 1 is explained. The migration machine 6 and the wireless contact 2 carry out to it being under communication link using slot 2S of a frequency f1. The slot for reserve channels (in this case, slot 4S) which is not usually used is prepared for the wireless contact 2, and the empty carrier is searched using this slot for reserve channels. The information about this empty carrier is put on slot 2S under communication link, is vacant, and is notified to the migration machine 6 as a notice of carrier information (in this case, a frequency f2, slot 4S). When an empty carrier becomes unusable, a new empty channel is searched, updated and notified.

[0009] In the meantime, the wireless contact 2 measures the receiving level of two or more points in slot 2S under communication link by the asynchronous interference detecting element 107, and reports the result to the communication channel control section 106. When the communication channel control section 106 performs asynchronous interference detection in connection with this measurement result and asynchronous interference is detected, it changes to the communication channel (a frequency f2, slot 4S) notified as empty carrier information. The migration machine 6 detects that the signal transmission which has received until now cannot receive, and changes it to the communication channel (a frequency f2, slot 4S) notified beforehand. In addition, forming the asynchronous interference detecting element 107 in the

migration machine 6 side, and also making it operate similarly is performed. All over drawing, slot 1S and slot 3S are shown, and other explanation is omitted.

[0010] Moreover, in No. 2553288 of a patent official report, the technique about the asynchronous interference evasion approach which becomes possible [detecting especially effectively exactly interference which an asynchronous interference wave does from the back of the burst frame in the signal wave of choice of a digital mobile radio communication link of time-division system, and starting interference evasion actuation efficiently] is exhibited.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since this invention is constituted as mentioned above, the effectiveness hung up over below is done so.

[0091] In the communication mode using TDMA-TDD which consists of a key station and a child office, it is enabling asynchronous interference evasion by the positive approach. This discovers the highest slot of received field strength, when asynchronous interference is detected, and it is that an assumed-parents station recognizes interference by interference which is a transmitting slot corresponding to the discovered slot, sends out an interference detection packet, and recognizes [station / which has been started in asynchronous interference / assumed-parents] in an interference detection packet, or is produced by interference detection packet sending out, and it is because an assumed-parents station is made to perform channel hop.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, there was a trouble hung up over below in the conventional technique. When coping with the asynchronous interference between the wireless contacts 2, 3, and 4 and 5 using the conventional asynchronous interference evasion method, an asynchronous interference detecting element will be prepared in the terminal side which are the migration machines 6, 7, 8, and 9. Then, although hopped to the communication channel as for which the terminal side detected interference by the asynchronous interference detecting element and which was notified beforehand, by not receiving the signal from a terminal side, the wireless contacts 2, 3, 4, and 5 will detect asynchronous interference, and will carry out channel hop. However, having consumed the power of a dc-battery other than the factor as for which interference generated and stopping receiving the signal from a terminal side if the terminal side is operating with the dc-battery carried out channel hop was also considered, and decision that interference occurred had the trouble of not being certain, by not receiving the signal from a terminal side.

[0012] This invention is made in view of this trouble, and the place made into the purpose is in the point of offering the technique about the asynchronous interference evasion approach and asynchronous interference evasion system which avoid interference certainly because an assumed-parents station makes a reception judgment of the packet for the interference detection transmitted from the child office in the assumed-parents station mediation mold network where an assumed-parents station exists.

[Translation done.]

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3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The summary of this invention according to claim 1 is the asynchronous interference evasion approach in a network. The direction packet for collision control of going down is received from the 1st assumed-parents station whose child office of the assumed-parents station mediation mold network which can serve as an assumed-parents station temporarily is said assumed-parents station. The 1st process which judges whether the unique WORD for a synchronization contained in this direction packet for collision control of going down was detected, When said direction packet for collision control of going down is sent out respectively and it interferes in it mutually to the timing from which said 1st assumed-parents station and the 2nd assumed-parents station which is other assumed-parents stations differ, said child office When said unique WORD cannot be detected in said 1st process, the 2nd process which counts the count of un-detecting of said unique WORD, and said child office When the count of reception of said direction packet for collision control of going down and the count of un-detecting of said unique WORD exceed the threshold set up beforehand respectively (more than), Judge that asynchronous interference has arisen between said 1st assumed-parents station, and it stops taking said 1st assumed-parents station and synchronization. temporary -- as the 3rd assumed-parents station -- operating -- this -- the 3rd process it enables it to transmit and receive to the slot timing of the 3rd assumed-parents station, and said 3rd assumed-parents station The 4th process which judges whether the slot from which the threshold beforehand set up out of the slot in all the frequencies currently used is exceeded (above), and the strongest received field strength is obtained was looked for, and the corresponding slot was detected, Said 3rd assumed-parents station judges it as the slot in which it has interfered between said 1st assumed-parents station, when said slot which corresponds at said 4th process is detected. The count (more than) exceeding the threshold beforehand set as the transmitting slot corresponding to said detected slot in the packet for interference detection, and the 5th process sent out continuously, Said packet of interference detection from said 3rd assumed-parents station Said 1st assumed-parents station, When sent out in accordance with the timing in the receiving slot in said 2nd assumed-parents station, or said 1st assumed-parents station, Or the 6th process which avoids interference of said direction packet for collision control of going down from hopping to the channel which said 2nd assumed-parents station has recognized reception of said packet of interference detection, and was computed with the random number, When said 3rd assumed-parents station hops to a channel with said 1st new assumed-parents station at said 6th process, It hops to the channel corresponding to the channel of said 1st assumed-parents station, and consists in the asynchronous interference evasion approach characterized by having the 7th process which receives said direction packet for collision control of going down from return and said 1st assumed-parents station in actuation of said child office. The summary of this invention according to claim 2 said 6th process When said packet of interference detection shifted from the timing in the slot of said 1st assumed-parents station and said 2nd assumed-parents station and is sent out from said 3rd assumed-parents station, If said 1st assumed-parents station and said 2nd assumed-parents station are counted exceeding the threshold set up beforehand (above), the count of un-detecting of said unique WORD at the period which could not detect said unique WORD but was set up

beforehand It judges respectively that it is the slot in which it has interfered, and consists in the asynchronous interference evasion approach according to claim 1 characterized by including the process which hops to the channel respectively computed with the random number. The summary of this invention according to claim 3 said 5th process When said slot which corresponds at said 4th process cannot be detected, said 3rd assumed-parents station If it judges that it was finished whether investigating all the slots and has finished investigating The timing of said slot is shifted a semicircle term and it consists in the asynchronous interference evasion approach according to claim 1 or 2 characterized by including the 8th process which returns to said 4th process which investigates the received field strength of all slots. The summary of this invention according to claim 4 consists in the asynchronous interference evasion approach according to claim 1 to 3 characterized by said 8th process including the process which ends processing when all the slots finish being investigated. The summary of this invention according to claim 5 said 1st process When said 1st assumed-parents station and said 2nd assumed-parents station have synchronized and sent out said direction packet for collision control of going down respectively using the same channel, Said child office detects said unique WORD, and since it becomes the packet with which the signal from said 1st assumed-parents station and the signal from said 2nd assumed-parents station interfered, an error is detected. When the count of reception of said direction packet for collision control of going down and the count of error detection of a packet exceed the threshold set up beforehand respectively (more than), The 9th process which judges that interference has arisen between said 1st assumed-parents station, and sends out the packet of a channel change demand to said 1st assumed-parents station and said 2nd assumed-parents station, Said 1st assumed-parents station and said 2nd assumed-parents station receive the packet of said channel change demand, and consist in the asynchronous interference evasion approach according to claim 1 to 4 characterized by including the 10th process which hops to the channel respectively computed with the random number. The summary of this invention according to claim 6 said 1st process When said 1st assumed-parents station and said 2nd assumed-parents station have sent out said direction packet for collision control of going down respectively by the separate channel, It is judged that said 1st assumed-parents station and synchronization have been taken since said child office detects said unique WORD and does not have detection of the error of a packet. It consists in the asynchronous interference evasion approach according to claim 1 to 5 characterized by including the process which operates according to actuation of the usual ad hoc protocol. For said 3rd process, the summary of this invention according to claim 7 is below the threshold (sheep) to which the count of un-detecting of said unique WORD was beforehand set when the count of reception of said direction packet for collision control of going down was below the threshold (following) set up beforehand. In **), it consists in the asynchronous interference evasion approach according to claim 1 to 6 characterized by returning to said 1st process. The summary of this invention according to claim 8 consists in the asynchronous interference evasion approach according to claim 1 to 7 characterized by said 9th process returning to said 1st process when the count of reception of said direction packet for collision control of going down is below the threshold (following) set up beforehand, or when said count of error detection of said packet is below the threshold (following) set up beforehand. The summary of this invention according to claim 9 said 3rd process The count exceeding the threshold beforehand set up in said packet of interference detection by all the slots that can be used when said child office operated as 3rd assumed-parents station temporarily (more than), When this 10th process is performed including the 10th process sent out continuously, it consists in the asynchronous interference evasion approach according to claim 1 to 8 characterized by not performing processing in said the 4th process and said 5th process. The summary of this invention according to claim 10 said 4th process When said corresponding slot is detected, it investigates whether said unique WORD is detected. The actuation which investigates whether the location of said slot is shifted before [a bit of] "1", and said unique WORD is detected when said unique WORD is not detected When said unique WORD is repeatedly detected in the range which can detect electric field, By sending out the packet of a channel change demand by the transmitting slot corresponding to said slot, said 1st assumed-parents station, Or when this

11th process is performed including the 11th process to which channel hop is carried out to said 2nd assumed-parents station, it consists in the asynchronous interference evasion approach according to claim 1 to 9 characterized by not performing processing in said 5th process. The summary of this invention according to claim 11 consists in the storage with which the program which can perform the asynchronous interference evasion approach according to claim 1 to 10 was recorded. The TDMA-TDD processing section which the summary of this invention according to claim 12 is an asynchronous interference evasion system in a network, and performs processing about TDMA-TDD, The clock section which generates a periodic pulse signal and is supplied to said RF section and said TDMA-TDD processing section, The ad hoc protocol processing section which processes the protocol used in an ad hoc network, The number storage section of receive packets which counts and memorizes the packet which received, The count storage section of unique WORD un-detecting which memorizes the count from which the unique WORD which the direction packet for collision control of going down sent out from the assumed-parents station of said network has was un-detecting, The count storage section of error detection which memorizes the count of error detection produced in the packet which received, It has the hop place channel calculation section which computes the channel which generates a random number and hops. It has two or more child offices which can operate said assumed-parents office temporarily. Said ad hoc protocol processing section Said unique WORD for said TDMA-TDD processing section to take the synchronization with said assumed-parents station and said child office is detected. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of error detection of the receive packet in said count storage section of error detection exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in the assumed-parents station of [1st] said assumed-parents stations which transmit information to said child office, and other 2nd assumed-parents station. Said TDMA-TDD processing section of said child office cannot detect said unique WORD. When the count of reception of said direction packet for collision control of going down in said number storage section of receive packets and the count of unique WORD un-detecting in said count storage section of unique WORD un-detecting exceed the threshold set up beforehand respectively (more than), It is judged that interference has arisen in said the 1st assumed-parents station and said child office. Said TDMA-TDD processing section Based on the decision in which said 1st assumed-parents station in said ad hoc protocol processing section and said 2nd assumed-parents station interfere, the RF section which performs transmission and reception, modulation, and recovery of an electric wave is minded. The packet of a channel change demand is sent out to said 1st assumed-parents station and said 2nd assumed-parents station. It is based on decision of interference with said 1st assumed-parents station in said ad hoc protocol processing section, and said child office. The threshold beforehand set up out of the slot in all the frequencies that are operating by the function of the 3rd assumed-parents station temporarily, and are used is exceeded (with above). The packet for interference detection is continuously sent out the number of times set up beforehand from the transmitting slot corresponding to the slot from which the strongest received field strength is obtained, And said hop place channel calculation section It is based on said packet of the channel change demand which received in said 1st assumed-parents station and said 2nd assumed-parents station, The channel which generates a random number respectively and hops to a degree is computed. Said 1st assumed-parents station, Or when reception of said packet of interference detection is judged in said 2nd assumed-parents station, Or when it judges said unique WORD of said packet of interference detection un-detecting, Or when said packet of interference detection is judged as an error packet by which the error was detected, The channel which generates a random number and hops to a degree in order to avoid interference is computed. Said 3rd assumed-parents station When said 1st assumed-parents station carries out channel hop, after hopping to the channel corresponding to the channel of said 1st assumed-parents station, It consists in the asynchronous interference evasion system characterized by receiving said direction packet for collision control of going down from said 1st assumed-parents station as return and said child office in actuation by the function of said child office. The summary of this invention according

to claim 13 said TDMA-TDD processing section The frame processing section which passes only the packet which is related to said ad hoc protocol processing section among the packets received from said RF section to said ad hoc protocol processing section, The slot processing section which embeds into the slot which had the transmitting packet which took out the receive packet of the slot specified out of the receiving bit string received from said RF section, and was received from said frame processing section specified, and is passed to said RF section, He is said ad hoc pro about the result of whether said unique WORD was detected from the receive packet, and said unique WORD was detected. It investigates [the unique WORD Banking Inspection Department which notifies to the TOKORU processing section, and] whether there is any error in a receive packet. When the result of error detection was notified to said ad hoc protocol processing section and an error is not detected, The error detection section which receives a receive packet from the unique WORD Banking Inspection Department which detected delivery and said unique WORD for the packet which received in said frame processing section, It has a field strength investigation means to investigate said received field strength. Said ad hoc protocol processing section For every non-detected notice of said unique WORD from said unique WORD Banking Inspection Department "1" is added and stored in the value of said count storage section of unique WORD un-detecting. "1" is added and stored in the value of said count storage section of error detection for every error indication of a receive packet from said error detection section. Detection of said unique WORD from said unique WORD Banking Inspection Department, Or it consists in the asynchronous interference evasion system according to claim 12 characterized by storing "1" in addition to the value of said number storage section of receive packets for every non-detected notice.

[0014]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing.

[0015] (Gestalt 1 of operation) Drawing 1 is drawing showing the outline of Network A of performing the asynchronous interference evasion approach concerning the gestalt 1 of this operation. As shown in drawing 1 , Network A is an ad hoc network which an outline configuration is carried out and can ~~~~~~ on that spot in the assumed-parents office 101 and two or more child offices 110, 111, and 112, and is an assumed-parents office mediation mold network where the assumed-parents office 101 exists.

[0016] The internal configuration of the assumed-parents station 101 and the child offices 110, 111, and 112 is the same, and it calls these station equipment collectively [the internal configuration]. One set becomes the assumed-parents office 101 out of two or more office equipments, and drawing 1 shows the condition that other office equipments are functioning as child offices 110, 111, and 112.

[0017] Next, the synchronization with the assumed-parents station 101 and the child office 110 (it represents out of the child offices 110, 111, and 112) is explained. Drawing 2 is drawing showing the synchronization between the assumed-parents office 101 of drawing 1 , and the child office 110.

[0018] The communication link between the assumed-parents station 101 and the child office 110 uses TDMA-TDD (Time Division Multiple Access-Time DivisionDuplex), and a TDMA multiplex number is "4." In Network A, one slot per ad hoc network A is used. The assumed-parents station 101 does not carry out taking the child office 110 and a synchronization, but operates to the slot timing of assumed-parents station 101 itself.

[0019] The child office 110 takes a synchronization so that the transmitting slot 114 of the assumed-parents station 101 and the receiving slot 117 of the child office 110 may correspond, and so that the receiving slot 115 of the assumed-parents station 101 and the transmitting slot 116 of the child office 110 may correspond.

[0020] In order for two or more child offices 110, 111, and 112 to share one slot in the receiving slot 115 of the assumed-parents station 101, the assumed-parents station 101 needs to cope with possibility that two or more child offices 110, 111, and 112 send out a packet to coincidence.

[0021] In Network A, the ICMA-PE (idle-signal casting multiple access with partial echo)

technique is used as the control approach of such a collision. In ICMA-PE, it gets down for collision control and the direction packet (the direction packet for collision control of going down is called hereafter) CP is always sent out to the child offices 110, 111, and 112 using the transmitting slot 114.

[0022] Drawing 3 is drawing showing the configuration of the direction packet CP for collision control of drawing 2 of going down. As shown in drawing 3 , the direction packet CP for collision control of going down gets down with unique WORD 201, and an outline configuration is carried out from an information signal 202, the free line / prohibition bit 203, reception / non-receiving bit 204, the partial echo field 205, and the error detection field 206.

[0023] Unique WORD 201 is the field for taking a synchronization, and is the bit pattern set up beforehand. It gets down and an information signal 202 is data transmitted from the assumed-parents station 101 to the child offices 110, 111, and 112. A free line / prohibition bit 203 displays "prohibition", when data are being received from a specific child office, and when forbidding access from other child offices, it is used.

[0024] Reception / non-receiving bit 204 displays "reception", when a signal without an error is received correctly, and when neither the case where there is an error which cannot be corrected, nor the signal is received, it indicates "un-receiving." When it indicates "un-receiving" during signal transmission, the child offices 110, 111, and 112 under data packet transmission halt transmit information, and go into a resending procedure.

[0025] The partial echo field 205 judges whether some received data are displayed, the child offices 110, 111, and 112 collate the information on this partial echo field 205, and the information which the local station sent, and the information which the local station sent is received correctly. The error detection field 206 does not have an error in the packet which received, or is used for a check.

[0026] In Network A, since the frequency which can be used can use four slots to those with 3 waves, and each frequency, a total of 12 channels exist. when it is judged that it investigates whether the assumed-parents station 101 is vacant, comes out and there is about each channel when building an ad hoc network, and comes out [it is vacant and], the direction packet CP for collision control of going down is continuously sent out using the channel [any]

[0027] Drawing 4 is the block diagram showing the outline configuration of the child offices 110, 111, and 112 of drawing 1 . As shown in drawing 4 , the outline configuration of the office equipment is carried out from the RF section 301, the clock section 302, the TDMA-TDD processing section 303, the ad hoc protocol processing section 304, the number storage section 305 of receive packets, the count storage section 306 of unique WORD un-detecting, the count storage section 307 of error detection, and the hop place channel calculation section 308.

[0028] The RF section 301 performs transmission and reception of an electric wave, a modulation, and a recovery. The clock section 302 generates a periodic pulse signal, and supplies it to the RF section 301 and the TDMA-TDD processing section 303.

[0029] The TDMA-TDD processing section 303 is equipped with the slot processing section 3031, the unique WORD Banking Inspection Department 3032, the error detection section 3033, the frame processing section 3034, and the field strength investigation means 3035, and performs processing about TDMA-TDD.

[0030] The slot processing section 3031 is embedded into the slot which had the transmitting packet which took out the receive packet from the slot specified out of the receiving bit string received from the RF section 301, and was received from the frame processing section 3034 specified, and is passed to the RF section 301.

[0031] The unique WORD Banking Inspection Department 3032 detects unique WORD 201 from the packet which received. The result of whether unique WORD 201 was detected is notified to the ad hoc protocol processing section 304. A receive packet is passed to the error detection section 3033 when unique WORD 201 is detected.

[0032] The error detection section 3033 investigates whether there is any error in the packet which received. The result of error detection is notified to the ad hoc protocol processing section 304. The packet which received is passed to the frame processing section 3034 when an error is not detected. The frame processing section 3034 passes only the packet which is

related to the ad hoc protocol processing section 304 among the received packets to the ad hoc protocol processing section 304.

[0033] The ad hoc protocol processing section 304 processes the protocol used in an ad hoc network. The number storage section 305 of receive packets counts and memorizes the packet which received. The field strength investigation means 3035 investigates received field strength.

[0034] The count storage section 306 of unique WORD un-detecting memorizes the count from which unique WORD 201 was un-detecting at the predetermined period.

[0035] The count storage section 307 of error detection memorizes the count of error detection produced at the predetermined period. If un-detecting [of unique WORD 201] is notified to the ad hoc protocol processing section 304 from the unique WORD Banking Inspection Department 3032, "1" is added to the count memorized by the count storage section 306 of unique WORD un-detecting, and the value is again stored in the count storage section 306 of unique WORD un-detecting. Moreover, if it is notified that there was an error of a receive packet from the error detection section 3033, "1" is added to the count stored in the count storage section 307 of error detection, and the value is again stored in the count storage section 307 of error detection. Moreover, if the notice which is not detected [detection or] is received from the unique WORD Banking Inspection Department 3032, "1" is added to the value stored in the number storage section 305 of receive packets, and the value is again stored in the number storage section 305 of receive packets. When this value turns into a predetermined value (for example, 240) set up beforehand, the ad hoc protocol processing section 304 reads the value memorized by the count storage section 306 of unique WORD un-detecting, and the count storage section 307 of error detection. If it is beyond the predetermined value (for example, 120) to which these values were set beforehand, it will judge that interference has occurred and actuation of interference evasion will be taken. "0" will be set to each of the number storage section 305 of receive packets, the count storage section 306 of unique WORD un-detecting, and the count storage section 307 of error detection if decision whether this interference has occurred finishes. The hop place channel calculation section 308 computes the channel which should hop to the degree in the case of hopping to other channels using a random number. In the case of the assumed-parents office 101, a random number is generated by making into the base ID assigned uniquely every assumed-parents office 101. In the case of the child offices 110, 111, and 112, a random number is generated using ID of the assumed-parents station 101 reported from the assumed-parents station 101.

[0036] Drawing 5 is drawing showing an example of the physical relationship of assumed-parents office (1st assumed-parents office) 101A and assumed-parents office (2nd assumed-parents office) 101B in the asynchronous interference evasion system concerning the gestalt 1 of this operation, and the child office 110. As shown in drawing 5, it is drawing showing the case where the child office 110 is located in the location which can receive respectively the direction packet CP for collision control of going down from assumed-parents office 101A and assumed-parents office 101B.

[0037] Drawing 6 is a flow chart which shows the actuation in the asynchronous interference evasion system concerning the gestalt 1 of this operation.

[0038] Next, actuation of the asynchronous interference evasion system applied to the gestalt 1 of this operation with reference to drawing 5 and drawing 6 is explained in detail.

[0039] The following three cases in case the child office 110 is going to receive the direction packet CP for collision control of going down from assumed-parents station 101A are explained.

[0040] The 1st case where assumed-parents station 101A and assumed-parents station 101B have transmitted the direction packet CP for collision control of going down by the separate channel to the child office 110, While assumed-parents station 101A and the child office 110 communicate, assumed-parents station 101B carries out channel hop at the same channel as assumed-parents station 101A. In the condition that assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down using the same channel The 2nd case where transmission and reception of assumed-parents station 101A and assumed-parents station 101B completely synchronize, and are transmitted to the timing that the direction packet CP for collision control of going down is

completely the same, Assumed-parents station 101A and assumed-parents station 101B are the 3rd case where do not synchronize but the direction packet CP for collision control of going down to the child office 110 has caused asynchronous interference.

[0041] When, as for the 1st case, assumed-parents station 101A and assumed-parents station 101B have transmitted the direction packet CP for collision control of going down by the separate channel and the child office 110 receives the direction packet CP for collision control of going down from assumed-parents station 101A, the unique WORD Banking Inspection Department 3032 detects unique WORD 201, and the error detection section 3033 is the case where an error is not detected.

[0042] first -- the slot processing section 3031 -- a packet -- receiving (step 401) -- the packet which received is sent to the unique WORD Banking Inspection Department 3032.

[0043] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 (shown in drawing 2) set up beforehand is detected (step 402).

[0044] In this case, since unique WORD 201 is detected (inside of drawing, Yes), it recognizes that the child office 110 has taken assumed-parents station 101A and a synchronization, and judges whether the error was detected by the packet by which this packet has been sent to the error detection section 3033 in delivery and the error detection section 3033 (step 403).

[0045] In this case, the sent packet (receive packet) is passed to the frame processing section 3034 by that (inside of drawing, No) by which an error is not detected (step 404).

[0046] In the frame processing section 3034, the class of packet which received is investigated and, in the case of the packet related to the ad hoc protocol processing section 304, the packet is passed to the ad hoc protocol processing section 304 (step 405).

[0047] The ad hoc protocol processing section 304 investigates the received packet, and operates according to actuation of an ad hoc protocol henceforth (step 406 (processing according to a receive packet is performed in the ad hoc protocol processing section 304)).

[0048] Drawing 7 is drawing showing an example of a condition synchronous [in drawing 6]. Next, the 2nd case is explained with reference to drawing 5 , drawing 6 , and drawing 7 . All over drawing, the transmitting slot 114 of assumed-parents station 101A and assumed-parents station 101B, the receiving slot 115, and the transmitting slot 116 and the receiving slot 117 of the child office 110 are shown.

[0049] Although assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down using the same channel, transmission and reception with assumed-parents station 101A and assumed-parents station 101B completely synchronize, and the case where the direction packet CP for collision control of going down is sent out to the completely same timing is explained.

[0050] In this case, the child office 110 -- the slot processing section 3031 -- a packet -- receiving (step 401) -- the packet which received is sent to the unique WORD Banking Inspection Department 3032.

[0051] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 set up beforehand is detected (step 402).

[0052] In this case, the direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B can be received, without being sent out to the completely same timing, and the signal of unique WORD 201 part deforming from assumed-parents station 101A and assumed-parents station 101B, since unique WORD 201 of the direction packet CP for collision control of going down is the same. Therefore, by that (inside of drawing, Yes) which can detect unique WORD 201, it recognizes that the child office 110 has taken assumed-parents station 101A and a synchronization, and the packet which received in the unique WORD Banking Inspection Department 3032 is sent to the error detection section 3033.

[0053] In the error detection section 3033, it judges whether the error was detected by the sent packet (step 403). Since the packet which received turns into a packet with which the signal of the signal of assumed-parents station 101A and assumed-parents station 101B interfered, it is that by which an error is detected in the error detection section 3033 (inside of drawing, Yes), and notifies that the error was detected to the ad hoc protocol processing section 304 (step

407).
[0054] If the notice by which the error was detected is received, the ad hoc protocol processing section 304 adds "1" to the count of error detection currently recorded on the count storage section 307 of error detection (step 408), and stores the value in the count storage section 307 of error detection.
[0055] This condition is repeated and it judges whether the value stored in the number storage section 305 of receive packets exceeded the threshold (for example, 240) set up beforehand (step 409 (the value stored in the number storage section 305 of receive packets exceeded the threshold ?)).
[0056] When it is not over the threshold at step 409 (inside of drawing, No), it returns to step 401.
[0057] When a threshold is exceeded at step 409 (inside of drawing, Yes), it judges whether the value of the count storage section 307 of error detection exceeded the predetermined threshold (for example, 120 times) (step 410 (the count of error detection exceeded the threshold ?)).
[0058] When it is not over the threshold at step 410 (inside of drawing, No), it returns to step 401.
[0059] When a threshold is exceeded at step 410 (inside of drawing, Yes), it is judged that interference has produced the ad hoc protocol processing section 304. As opposed to the frame processing section 3034 the packet of the channel change demand CS 1 (shown in drawing 7) delivery and the frame processing section 3034 Delivery and the slot processing section 3031 send out channel change demand CS1 packet for the packet from the ad hoc protocol processing section 304 to the slot processing section 3031 through the RF section 301 towards assumed-parents station 101A and assumed-parents station 101B (step 411).
[0060] Assumed-parents station 101A and assumed-parents station 101B which received channel change demand CS1 packet compute the channel which should hop to a degree using a random number, and perform channel hop respectively.
[0061] Drawing 8 is drawing showing other examples of a condition synchronous [in drawing 8] The 3rd case is explained with reference to drawing 5 , drawing 6 , and drawing 8 . Assumed-parents station 101A and assumed-parents station 101B have sent out the direction packet CP for collision control of going down to the child office 110 using the same channel, and further, assumed-parents station 101A and assumed-parents station 101B do not synchroniza, but explain the 3rd case where the direction packet CP for collision control of going down has caused asynchronous interference.
[0062] the child office 110 — the slot processing section 3031 — a packet — receiving (step 401) — the packet which received is sent to the unique WORD Banking Inspection Department 3032.
[0063] The unique WORD Banking Inspection Department 3032 investigates whether unique WORD 201 set up beforehand is detected (step 402).
[0064] The direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B it interferes in the form which shifted without being sent out to the same timing. In the child office 110 Unique WORD 201 in the direction packet CP for collision control of going down which received set up beforehand is undetectable (among drawing). It becomes impossible to take No), assumed-parents station 101A, and a synchronization (assumed-parents station 101B cannot take a synchronization), and it notifies that unique WORD 201 was undetectable to the ad hoc protocol processing section 304 (step 412).
[0065] If the notice which was not able to detect unique WORD 201 is received from the unique WORD Banking Inspection Department 3032, the ad hoc protocol processing section 304 adds "1" to the count of unique WORD un-detecting stored in the count storage section 306 of unique WORD un-detecting, and stores it in the count storage section 306 of unique WORD un-detecting again (step 413 (1 is added to the count currently recorded on the count storage section 306 of unique WORD un-detecting)).
[0066] When the value stored in the number storage section 305 of receive packets judges whether the threshold (for example, 240) set up beforehand was exceeded (step 414) and is not

over the threshold at step 414 (inside of drawing, No), it returns to step 401.
[0067] When it judges whether the value of the count storage section 306 of unique WORD un-detecting of ** exceeded the threshold (for example, 120 times) set up beforehand when a threshold was exceeded at step 414 (inside of drawing, Yes) (step 415 (the count of unique WORD un-detecting exceeded the threshold ?)) and is not over the threshold at step 415 (inside of drawing, No), it returns to step 401.
[0068] Judging that asynchronous interference has produced the ad hoc protocol processing section 304, when a threshold is exceeded at step 415 (inside of drawing, Yes), the child office 110 is assumed-parents station 101A (). Or it stops taking assumed-parents station 101B and a synchronization, the child office 110 turns into an assumed-parents station (un-illustrating [the 3rd assumed-parents station,]) temporarily (step 416), and it enables it to transmit and receive to its slot timing.
[0069] Next, in the child office 110 which turned into the 3rd assumed-parents station temporarily, the field strength investigation means 3035 looks for the slot from which the received field strength in all the slots of the frequency currently used is investigated, and the field strength more than the threshold (for example, 40dB) set up beforehand is detected, and the strongest received field strength is obtained (step 417). (the field strength of all slots is investigated and the slot of a heavy current community is looked for most)
[0070] It judges whether the slot looked for at step 417 was found (step 418).
[0071] When the slot looked for at step 418 is detected (inside of drawing, Yes), the 3rd assumed-parents station The detected slot judges it as the slot in which the direction packet CP for collision control of going down from assumed-parents station 101A and assumed-parents station 101B has interfered mutually. the count more than the threshold (for example, 120 times) beforehand set as it in the packet of the interference detection D1 in order to recognize an interference condition into the transmitting slot 116 corresponding to this slot — it sends out continuously (step 419 (continuation 120 slot sending out of the "interference detection" packet is carried out)).
[0072] When it is completely in agreement with the timing in assumed-parents office 101A or the receiving slot 115 of assumed-parents office 101B and the packet of this interference detection D1 is able to be sent out, assumed-parents office 101A or assumed-parents office 101B can recognize the packet of the interference detection D1. Therefore, assumed-parents station 101A which has recognized the packet of the interference detection D1, or assumed-parents station 101B acquires the channel of the hop place which the hop place channel calculation section 308 computed (step 420), hops to the acquired channel (step 421), and avoids interference of the direction packet CP for collision control of going down.
[0073] On the other hand, when it shifts from the timing in each receiving slot 115 of assumed-parents station 101A and assumed-parents station 101B and the packet of the interference detection D1 is sent out at step 419, it is with assumed-parents station 101A and assumed-parents station 101B, and unique WORD 201 is un-detecting. count reception, when it carries out, it is the slot in which it has interfered more than the threshold (for example, 120) with which assumed-parents station 101A or assumed-parents station 101B was beforehand set as the period set up beforehand in the non-detected packet of unique WORD 201 — it recognizes. Assumed-parents station 101A which has recognized interference, or assumed-parents station 101B acquires the channel of the hop place which the hop place channel calculation section 308 computed (step 420), and hops to the acquired channel.
[0074] The channel of the hop place at which similarly the child office 110 which is the 3rd assumed-parents station temporarily also generated and computed the random number using ID of assumed-parents station 101A to which the hop place channel calculation section 308 is reported from assumed-parents station 101A is acquired, and it hops to the acquired channel (step 421).
[0075] The 3rd assumed-parents station returns to the child office 110 (it becomes a child office) (step 422), and tries reception of the direction packet CP for collision control of going down from assumed-parents station 101A again.
[0076] If it judges that it was finished whether conducting all slot investigations (step 423) and

has finished judging at step 418 when the slot looked for is undetectable (inside of drawing, No), the timing of a slot is shifted a semicircle term (step 424), it returns to step 417, and the received field strength of all slots is investigated again.

[0077] Processing is ended when finishing judging at step 423 (inside of drawing, Yes).

[0078] Asynchronous interference evasion is made between assumed-parents station 101A and the child office 110 as mentioned above.

[0079] Since the asynchronous interference evasion approach and asynchronous interference evasion system concerning the gestalt of operation are constituted like the above, the effectiveness hung up over below is done so.

[0080] When asynchronous interference is detected, discover the highest slot of received field strength and by the transmitting slot corresponding to the slot Assumed-parents station 101A which sent out the interference detection packet and has caused asynchronous interference, Or [whether assumed-parents station 101B recognizes an interference detection packet and] Or since assumed-parents station 101A or assumed-parents station 101B is made to perform channel hop because assumed-parents station 101A or assumed-parents station 101B recognizes interference by interference produced by interference detection packet sending out, asynchronous interference evasion is enabled by the positive approach. The received electric wave in the network A equipped with many child offices is finely manageable by using this asynchronous interference evasion approach for the monitoring device of the child office 110.

[0081] (Gestalt 2 of operation) Drawing 9 is drawing showing an example of a condition synchronous [in the asynchronous interference evasion system concerning the gestalt 2 of this operation]. Since the asynchronous interference evasion structure of a system concerning the gestalt 2 of this operation is the same as that of the gestalt 1 of operation, explanation is omitted.

[0082] Although the slot with the strongest received field strength was looked for in the actuation after step 417 in drawing 6 and the packet of the interference detection D1 was sent out by the transmitting slot corresponding to the slot, as shown in drawing 9 , the packet of the interference detection D1 is sent out by all slots. It becomes unnecessary in this case, to look for a slot with the strongest received field strength. Explanation of other signs is omitted.

[0083] Channel hop can be made to cause in an assumed-parents office certainly by performing this actuation compared with the gestalt 1 of operation.

[0084] (Gestalt 3 of operation) Drawing 9 is drawing showing an example of a condition synchronous [in the asynchronous interference evasion system concerning the gestalt 3 of this operation]. Since the asynchronous interference evasion structure of a system concerning the gestalt 3 of this operation is the same as that of the gestalt 1 of operation, explanation is omitted.

[0085] If a slot with the highest received field strength is acquired at step 418 in drawing 6 , it will investigate whether unique WORD 201 is detected (un-illustrating).

[0086] When unique WORD is not detected, as shown in drawing 10 , the location of the slot is shifted before [a bit of] "1", and it investigates whether unique WORD 201 is detected again. This actuation is repeated in the range which can detect electric field, and it investigates whether unique WORD 201 is obtained. If unique WORD 201 is obtained, assumed-parents office 101A and the synchronization which transmit the unique WORD 201 can be taken. Therefore, by sending out the channel change demand CS 1 by the transmitting slot 116 corresponding to the receiving slot 117, a channel can be made to be able to hop to assumed-parents office 101A, without generating interference intentionally, and interference can be avoided.

[0087] In addition, in the gestalt of this operation, this invention is not limited to it, but when applying this invention, it is applicable to the technique about the suitable asynchronous interference evasion approach and a suitable asynchronous interference evasion system.

[0088] Moreover, the number of the above-mentioned configuration members, a location, a configuration, etc. are not limited to the gestalt of the above-mentioned implementation, but when carrying out this invention, they can be made into a suitable number, a location, a configuration, etc.

[0089] In addition, in each drawing, the same sign is given to the same component.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the network outline of performing the asynchronous interference evasion approach concerning the gestalt 1 of operation of this invention.
[Drawing 2] It is drawing showing the synchronization between the assumed-parents office of drawing 1, and a child office.
[Drawing 3] It is drawing showing the configuration of the direction packet for collision control of drawing 2 of going down.
[Drawing 4] It is the block diagram showing the outline configuration of the child office of drawing 1.
[Drawing 5] It is drawing showing an example of the physical relationship of the 1st assumed-parents station and the 2nd assumed-parents station in the asynchronous interference evasion system concerning the gestalt 1 of operation of this invention, and a child office.
[Drawing 6] It is the flow chart which shows the actuation in the asynchronous interference evasion system concerning the gestalt 1 of operation of this invention.
[Drawing 7] It is drawing showing an example of a condition synchronous [in drawing 6].
[Drawing 8] It is drawing showing other examples of a condition synchronous [in drawing 6].
[Drawing 9] the asynchronous interference evasion system concerning the gestalt 2 of operation of this invention — it is drawing showing an example of the synchronous condition to kick.
[Drawing 10] It is drawing showing an example of a condition synchronous [in the asynchronous interference evasion system concerning the gestalt 3 of operation of this invention].
[Drawing 11] It is the block diagram showing an example of a method which avoids asynchronous interference of the conventional technique.
[Drawing 12] It is the block diagram showing the configuration of the wireless contact of drawing 11.
[Drawing 13] It is drawing showing the flow of the actuation in the wireless communication control unit of drawing 11.
[Description of Notations]
A Network
CP The direction packet for collision control of going down
CS1 Channel change demand
D1 Interference detection
f1 Frequency
f2 Frequency
1S Slot
2S Slot
3S Slot
4S Slot
1 Wireless Communication Control Unit
2, 3, 4, 5 Wireless contact
6, 7, 8, 9 Migration machine
10A, 10B, 10C, 10D Wireless zone

101X Antenna section
102 Wireless Section
103 Modem Section
104 Frame Generation / Decomposition Section
105 Control Channel Control Section
106 Communication Channel Control Section
107 Asynchronous Interference Detecting Element
108 Interface Section
109 Slot Synchronizer
101 Assumed-Parents Station
101A Assumed-parents station (1st assumed-parents station)
101B Assumed-parents station (2nd assumed-parents station)
110, 111, 112 Child office
114 Transmitting Slot
117 Receiving Slot
115 Receiving Slot
116 Transmitting Slot
201 Unique WORD
202 Get Down and it is Information Signal
203 Free Line / Prohibition Bit
204 Reception / Non-Receiving Bit
205 Partial Echo Field
206 Error Detection Field
301 The RF Section
302 Clock Section
303 TDMA-TDD Processing Section
304 Ad Hoc Protocol Processing Section
305 The Number Storage Section of Receive Packets
306 Count Storage Section of Unique WORD Un-Detecting
307 Count Storage Section of Error Detection
308 Hop Place Channel Calculation Section
3031 Slot Processing Section
3032 Unique WORD Banking Inspection Department
3033 Error Detection Section
3034 Frame Processing Section
3035 Field Strength Investigation Means

[Translation done.]

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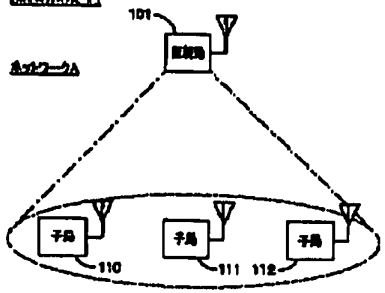
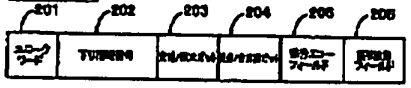
DRAWINGS

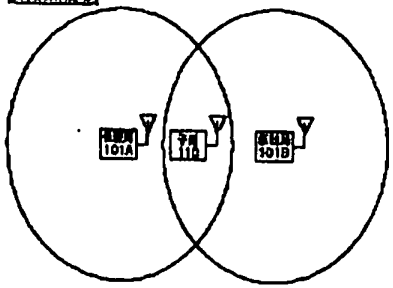
[Drawing 1]



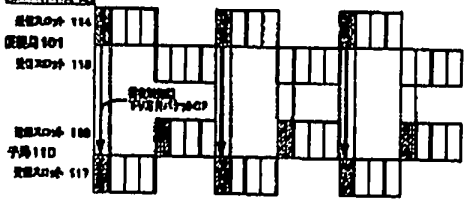
[Drawing 3]



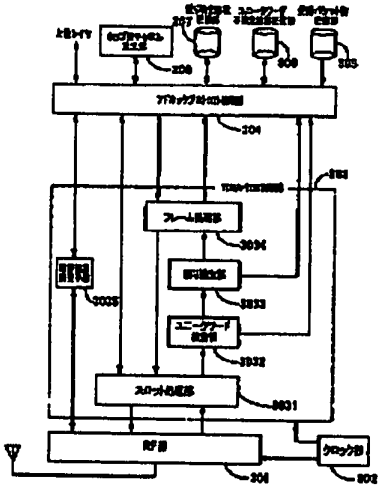
[Drawing 5]



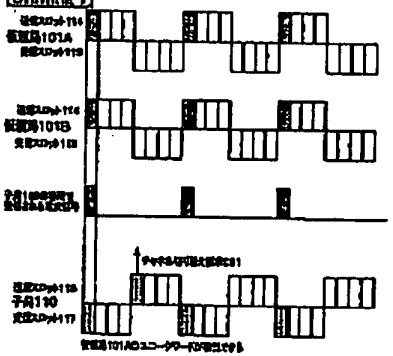
[Drawing 2]



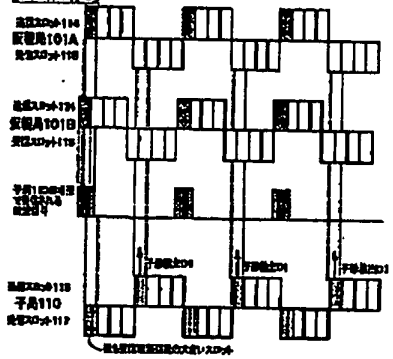
[Drawing 4]



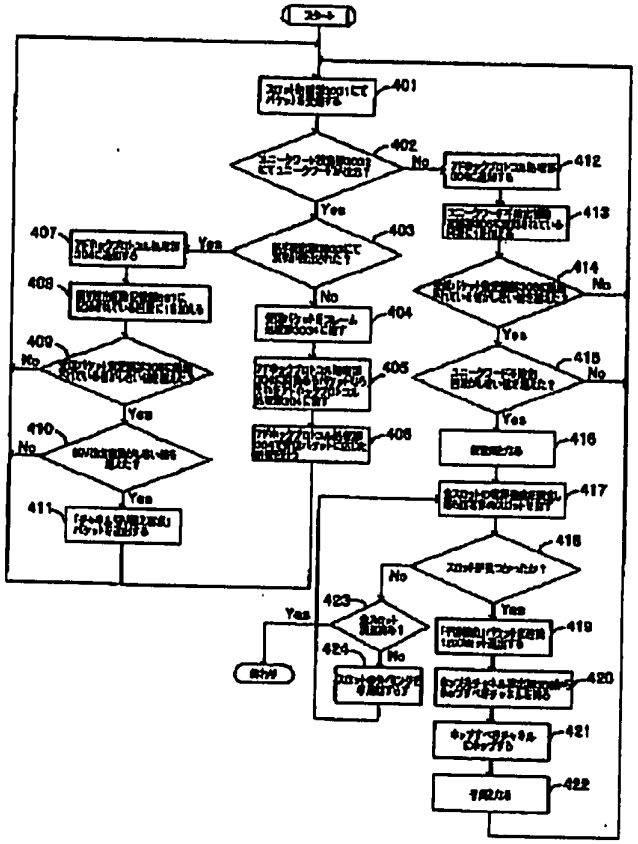
[Drawing 7]



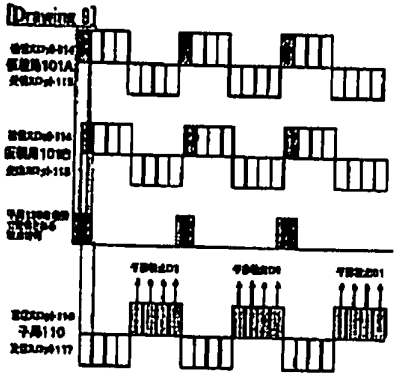
[Drawing 8]



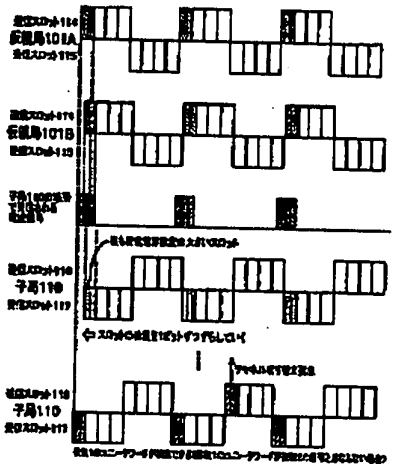
[Drawing 6]



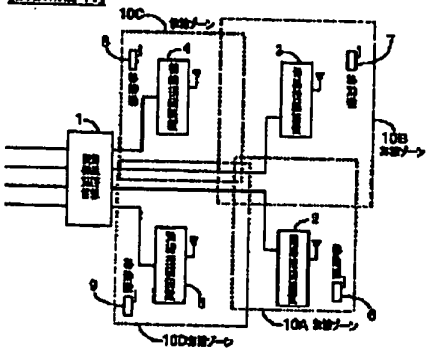
[Drawing 9]



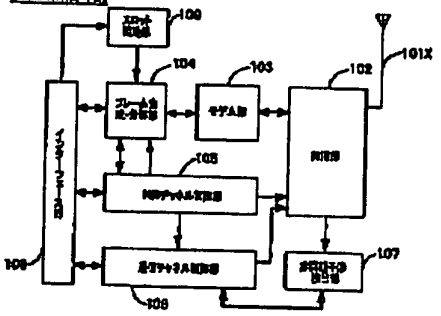
[Drawing 10]



[Drawing 11]



[Drawing 12]



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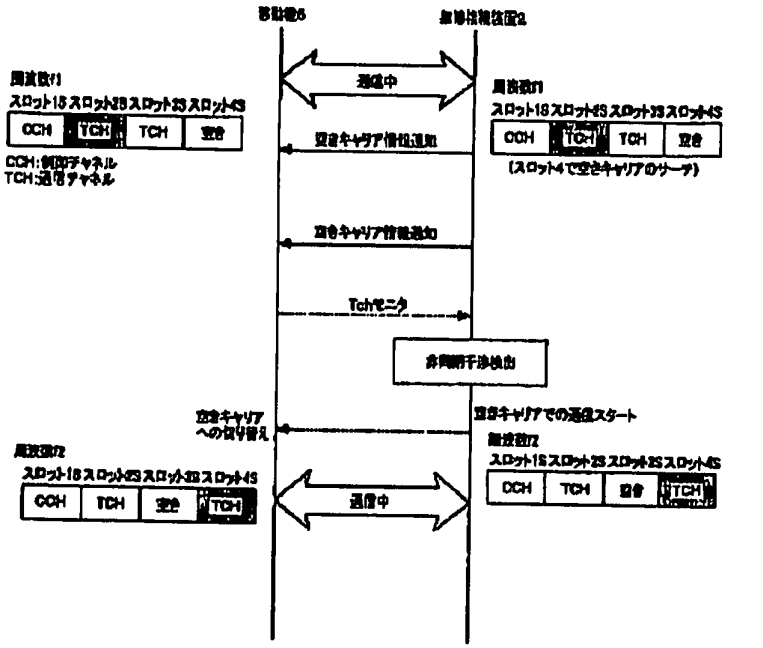
[Drawing 13]



[Translation done.]